Space Weather Technical Forecast

Issued on Friday 25 October 2024 at 12:06 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: M-flares likely, slight chance of further X-flares. Chance G1-G2/Minor-Moderate geomagnetic storm intervals days 2 and 3 (26/27 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate in the past 24 hours with an isolated M1.1 flare at 25/0733 UTC originating from AR3873, near the east limb. There are currently ten numbered spot regions on the disc. The main focus is toward the southeast of the disc, with three significant regions located here. These are (from west to east) AR3869, AR3872, and AR3873. AR3869 and AR3872 appear to comprise mature penumbra around both leading and trailing regions, each with modest magnetic complexity. AR3873, near the east limb appears to be a moderately sized bipolar region, with a elongated asymmetric trailing spot. Most other regions on the disc are smaller or simple and exhibit only small changes in evolution.

The strong X3.3 flare produced by AR3869 on 24 Oct gave a CME that has been assessed as a likely miss, passing behind Earth, though some Earth-directed component is possible from shock possibly arriving 26 or 27 Oct. No other Earth directed CMEs (coronal mass ejections) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds were generally indicative of background conditions. Speeds, observed by ACE at L1, were slow-ambient, easing gradually from 350 to near 300 km/s. Density was around average or below. The Interplanetary Magnetic Field (IMF) remained weak, to 2-6nT. The north-south component was mostly negative (southward) until 24/2200 UTC, then became mainly positive, peaks -5nT and +5nT. Phi angle was positive (away from the Sun) until 24/2200 UTC, then switched to negative (toward the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background levels, with a very slight enhancement above baseline after the X3.3 flare. High energy electron flux (greater than 2MeV) observed by GOES16 remained at background. The associated 24-hour fluence was well below the Active threshold, with 1.55e6 integrated flux observed at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate is expected, with M-class flares considered likely and a slight chance of further X-class flares.

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Solar Wind / Geomagnetic Activity: The are currently no Earth-directed CMEs, but two or three CMEs which may give shock or glancing impacts day 2 or day 3 (26/27 Oct). Solar winds are currently at background levels. Winds are expected to remain at largely background levels until day 2 (26 Oct) with fast winds from CH84/- peaking at slightly elevated or elevated speeds before waning during day 3 (27 Oct).

Activity is expected to be largely Quiet to Unsettled (Kp 1-3) to start. The combined onset of any enhancement from CH84/-, and the influence of any shock or glancing CME impacts brings a chance of G1-G2/Minor-Moderate geomagnetic storms (Kp5-6) during day 2 (26 Oct) or early day 3 (27 Oct) before easing into day 4 (28 Oct).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. High energy electron flux at GOES16 is forecast to remain at mainly background, with the associated 24 hour fluence remaining well below Active.

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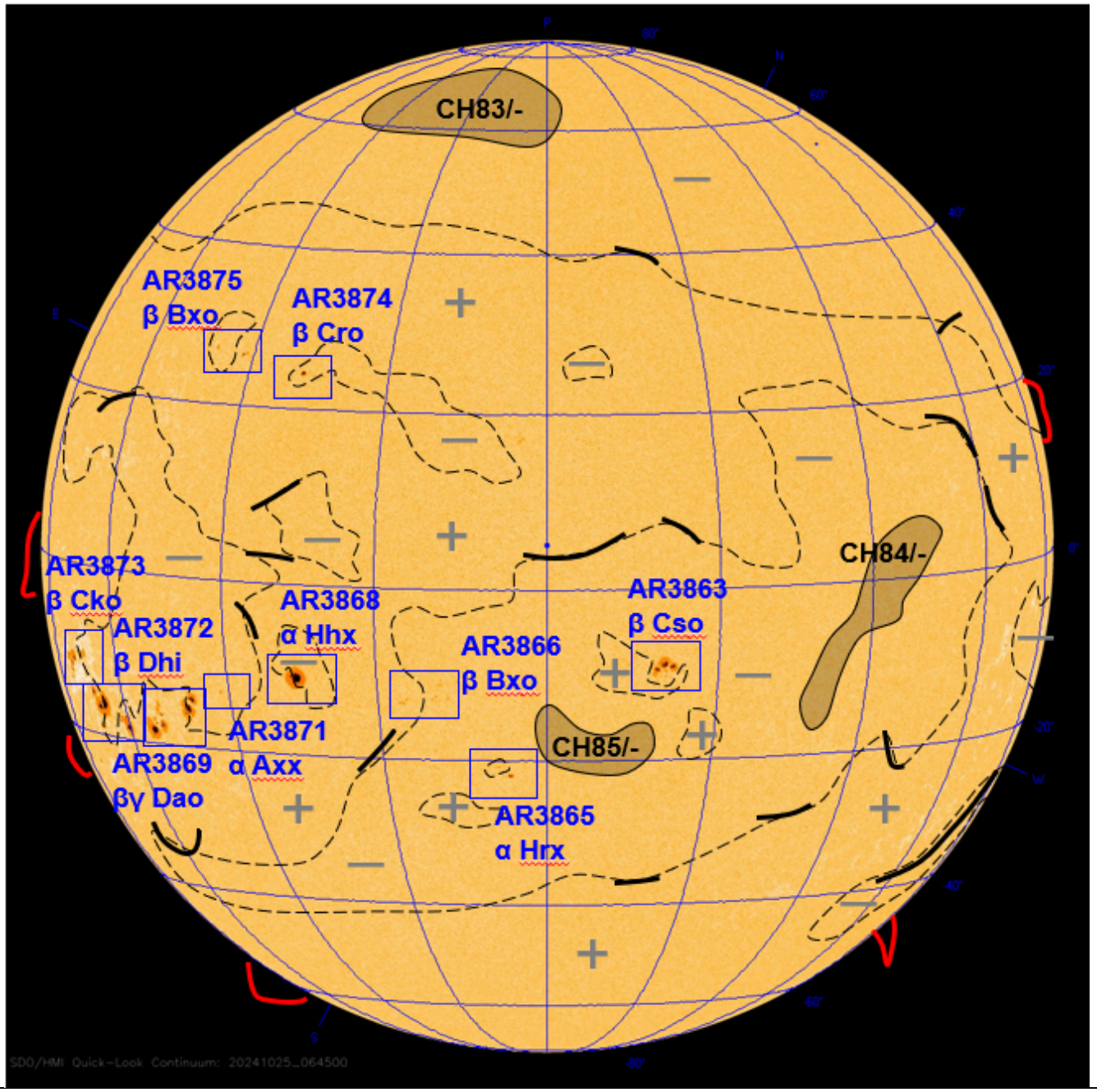
Figure 1: Solar synoptic map VT 25/0700 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

The are currently no Earth-directed CMEs. A number of weak CMEs from 23 Oct have been modelled to miss Earth, although there remains an element of uncertainty in the nature of the CME observed around 23/1230UTC and the potential for an Earth-directed component and glancing blow on 26 Oct. The main CME of note for the forecast period is from the X3.3 flare at 24/0357 UTC. This CME originated from close to the southeast limb, with the bulk of ejecta expected to pass to the south of Earth. However, there remains the possibility of a glancing blow from shock during 26 or 27 Oct which may sweep up the previously mentioned CME.

Solar winds are currently at background levels. Winds are expected to remain at largely background levels until day 2 (26 Oct) with fast winds from CH84/- peaking at slightly elevated or elevated speeds before waning during 27 Oct. Enlil wind speed projections are considered reasonable if not a little late, with SWPM supporting similar peak values.

Activity is expected to be largely Quiet to Unsettled (Kp 1-3) to start. The combined onset of any enhancement from CH84/-, and the influence of any shock or glancing CME impacts brings a chance of G1-G2/Minor-Moderate geomagnetic storms (Kp5-6) during day 2 (26 Oct) or early day 3 (27 Oct) before easing into day 4 (28 Oct).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	10	40	30	10
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

Solar activity has been Moderate in the past 24 hours with an isolated M1.1 flare at 25/0733 UTC originating from AR3873, near the east limb. Low to Moderate activity is generally expected with isolated M-flares likely and a slight chance of further isolated X-flares. These are most probable from the regions in the southeastern disc.

There are currently ten numbered spot regions on the disc. The main focus is toward the southeast of the disc, with three significant regions located here. These are (from west to east) AR3869, AR3872, and AR3873. AR3869 and AR3872 appear to comprise mature penumbra around both leading and trailing regions, each with modest magnetic complexity. AR3873, near the east limb appears to be a moderately sized bipolar region, with a elongated asymmetric trailing spot. Most other regions on the disc are smaller or simple and exhibit only small changes in evolution.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	60	60	60	60
Very Active	R3-R5 (X Class)	No	10	10	10	10

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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is forecast to remain at background, although some slight proton enhancement is possible should further significant flares occur. The current most active regions located near the east limb, will gradually transit toward centre disc by the end of the period allowing a greater risk of proton enhancements.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is currently at background, and is expected to persist mainly at this level with no significant enhancements expected.

The associated 24-hour fluence is currently expected to remain well below Active throughout the period, with MOSWOC REFM providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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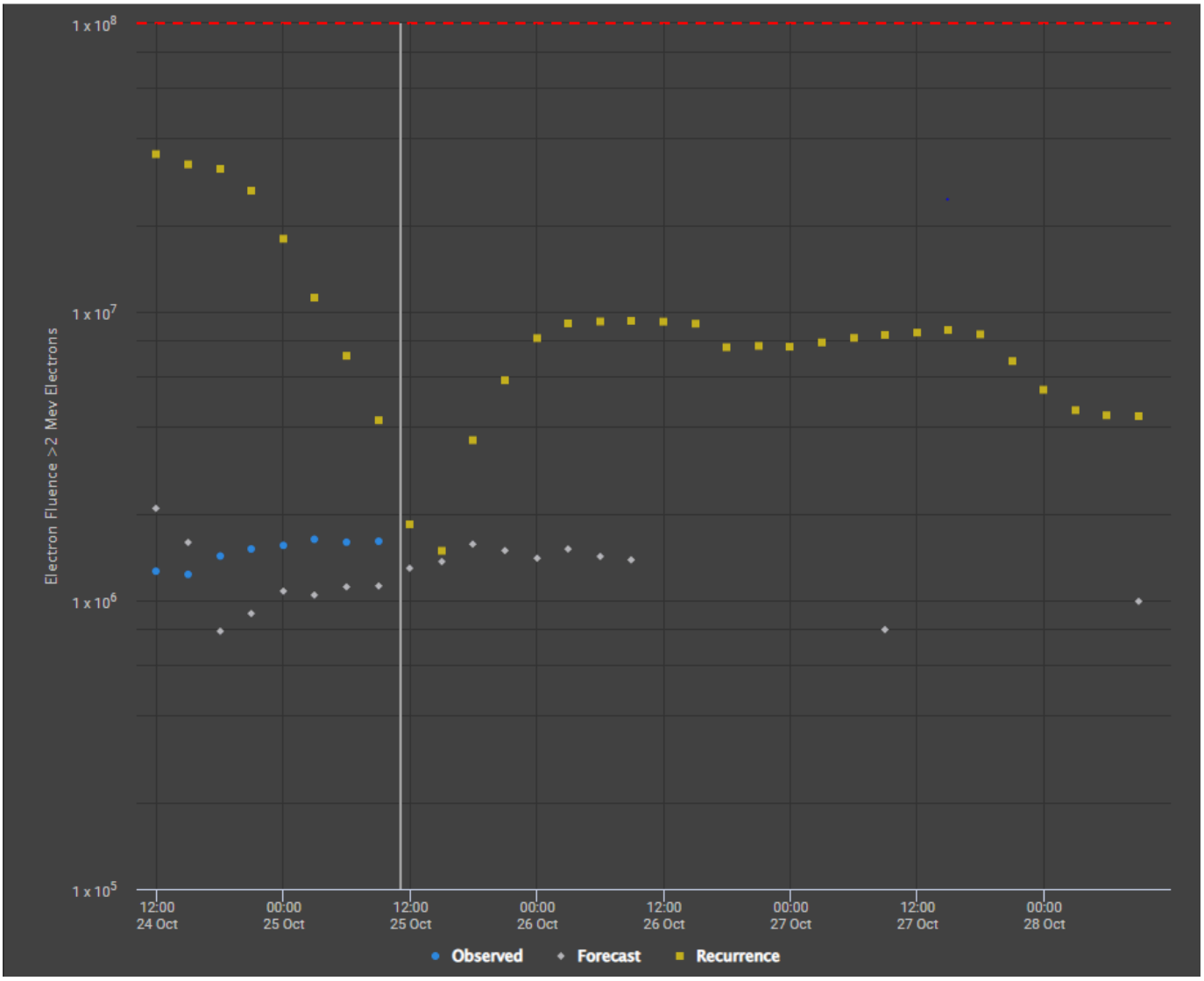
Figure 2: MOSWOC REFM



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